UNITED STATES DEPARTMENT OF AGRICULTURE
WAR FOOD ADMINISTRATION
Food Distribution Administration
and
AGRICULTURAL RESEARCH ADMINISTRATION
Bureau of Plant Industry, Soils, and Agricultural Engineering

ADDITIONAL STORAGE FACILITIES NEEDED FOR INCREASED SWEETPOTATO CROP

CONTENTS

Increased production of sweetpotatoes is anticipated as a result of the announced 1943 goal and the price support program of the War Food Administration. Storage facilities must be greatly expanded to meet the expected increase.

The recommendations by J. W. Simons, of the Bureau of Plant Industry, Soils, and Agricultural Engineering of the Agricultural Research Administration, (page 5), were prepared for use in guiding those faced with the responsibility of selecting and converting buildings so that they will have a basis for making a choice and equipping and operating the storages.

SWEETPOTATO MARKETING PROGRAM FOR 1943

General Information

The United States Department of Agriculture announced a 1943 goal for sweetpotatoes of one million acres, an increase of about 33 percent over the 1942 acreage. If the million-acre goal is reached, and commercial sources indicate this is possible, production, on the basis of average growing conditions would amount to 82 million bushels, compared with 65 million bushels in 1942.

The price support program for sweetpotatoes was announced on March 18 to encourage growers to plant a larger acreage, but it was too late to affect growers' intentions as reported on March 1, when they indicated that 813,300 acres would be planted, or an increase of 14 percent over that of 1942.

The schedule of support prices is as follows:

August through November, $1.15 per bushel; December and January, $1.30; and February through April, $1.45; for sweetpotatoes grading U. S. No. 1 and packed in rigid bushel containers. The containers may be either new or second hand, provided the second hand containers are in good condition. Those grading U. S. Commercial 75 percent or better U. S. No. 1 will be supported at 15 cents per bushel below prices for U. S. No. 1 grade. Also, sweetpotatoes have been classed as a war crop and farmers are given the opportunity to substitute them for soy beans and peanuts in reaching the goal for essential was crops.

Reports received following the announcement of the price support program indicate that there will be a substantial increase in the acreage of sweetpotatoes in areas that have not grown and marketed substantial quantities in previous years, This situation will create an acute problem of curing, storing, and marketing.

Under present conditions, a crop considerably above average can be absorbed at comparatively high prices. It is likely that a crop of 82 million bushels, if properly stored and marketed over a long season, would be entirely absorbed in commercial marketing channels at prices above support levels. It should be kept in mind, however, that during the 1936-40 period, only about 38 percent of the sweetpotato production was offered for sale. There will be a moderate incentive for growers to hold a quantity of sweetpotatoes on the farm for home use, as other foods to be purchased will be high, and in purchasing some foods, it is necessary

to use ration points. This tendency may be somewhat offset as the support price at harvest time may induce the selling of a large quantity, especially in areas where storage facilities are inadequate.

Need for Storage

The losses of sweetpotatoes stored in banks or mounds are often excessive, and in areas where this practice is common, it is likely that additional storage facilities will be needed, even though the increase in acreage may be small. The curing and storage of sweetpotatoes have always presented a serious problem in the orderly marketing of the crop. In some areas, growers and shippers have made a practice of selling the crop as soon as it is harvested, which means that even during years of small surpluses, more sweetpotatoes were offered for sale than could be absorbed through the marketing channels. When this happened, they began selling sweetpotatoes on consignment and many sales would fail to return freight and packaging charges. In most seasons, there is a sufficient advance in price during the marketing season to make storage profitable. If sweetpotatoes are properly cured and if the storage house is maintained at approximately 55° during the storage period, the shrinkage should be less than 10 percent.

The seasonal advance in the support prices was designed to encourage the storage and marketing of sweetpotatoes over the longest possible season. It is likely that commercial prices will be considerably above the support price for a large portion of the season. In any event, growers and shippers who store sweetpotatoes are assured a price of $1.45 per bushel in the spring if the commercial markets will not absorb all the sweetpotatoes.

Building Material

Some building materials are more critical than others, and for that reason, sweetpotato storage should be planned to use a minimum of such materials. It does not require a priority to purchase substitutes, such as cinder blocks, concrete blocks, various types of composition board, rough lumber, asphalt shingles, and other types of composition roofing. Finished lumber is very scarce, and almost as difficult to obtain as steel. More favorable consideration will be given the priority application if the applicant has made the greatest possible use of the above named substitutes. If the use of less critical materials is not specified in the plans, usually the applicant is requested to make certain substitutions. This procedure delays action on the application.

Containers

Due to the shortage of lumber, labor, and equipment in the box, crate, and basket industry, it is likely that production of these containers will be reduced about one-third, while the demand for these packages will be about 30 percent over the 1942 requirements. It will be virtually impossible for the sweetpotato industry to obtain enough wooden containers for storing the crop during the fall months unless growers and shippers immediately start purchasing second hand containers. These containers should be purchased and delivered to the shipping point or to the farm where they will be used. Second hand dealers in the cities have very limited storage space, and they are not inclined to collect used containers in excess of their warehouse facilities. Growers could use many off-size crates and boxes for storage, such as lettuce and orange crates. Such a practice would give them a longer period of time to purchase the bushel crates and baskets for shipment to the market.

Considerable publicity should be given by both State and local agricultural offices to the salvage and reclamation program of used containers. The probable shortage of containers can be met by a vigorous educational program to impress both growers and shippers with the seriousness of the situation.

CONVERTING BUILDINGS INTO SWEETPOTATO STORAGES

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Large storage facilities will be needed for the anticipated increase in the sweetpotato crop. Existing farm and commercial storages are inadequate, and building materials and labor are scarce, so it may be necessary to convert unused farm structures or village buildings into storages.

Requirements For Sweetpotato Storage

Sweetpotatoes require heat for proper curing and storing which necessitates a building tight enough to hold the heat and to permit control of ventilation. Proper handling during harvest and good management of the house are essential for safe storage. Less damage will occure if the potatoes are sorted and placed in containers in the field prior to storing. Potatoes of different varieties should be placed in different compartments because some varieties stand storage better than others. In large storages, compartments of not over 2,000 bushels capacity are desirable, because complete filling of the rooms results in more uniform curing and lower heating cost per bushel. Also, the containers should be carefully stacked so that the tiers or rows will not topple. Large losses will be sustained should this occur.

For proper curing the temperature in a sweetpotato house must be maintained at about 85° with a relative humidity of 85 to 90 percent. Some ventilation is needed but usually ventilators may be closed at night. Additional ventilation can be provided if any condensation is noted. The house should be maintained at the proper temperature at least one day prior to putting in potatoes as better curing results if the temperature of the potatoes can be brought quickly to the 85° level. Appearance of sprouts is an indication of complete curing which ordinarily occurs in about 10 days.

After curing, the temperature should be lowered over a period of several days to 50-55° F. Only enough ventilation is needed during storage to prevent an excessive rise in temperature or condensation of moisture.

Selection of Buildings for Remodeling.

Storage on farms is the most economical and satisfactory because a minimum of transportation is required and farm labor is available for managing the storage. For these reasons all suitable buildings on farms should be utilized. Large buildings could be used cooperatively by neighboring farmers. Grain bins and similar buildings which are of reasonably tight construction and are designed for heavy loads might be most easily converted into sweetpotato storages.

When remodeling buildings for extended use or when building new ones, some of the recommendations given in Farmers' Bulletin 1442, "Storage of Sweetpotatoes," may be followed. Recent studies have shown that houses with an earth floor and solid foundations permit easier control of temperature and humidity than the elevated wooden floor shown in the bulletin. Such construction is lower in cost and is especially recommended during the war because of the saving of lumber. About half the number of the ventilators recommended in the bulletin are believed to be sufficient in most instances. Also the full amount of insulation provided is not needed in all zones. (See table 2)

Flue-heated tobacco barns are used as sweetpotato storages and require little remodeling. See Farmers' Bulletin 1267, "Utilization of Flue-Heated Tobacco Barns for Sweet-Potato Storage."

Village buildings can be used, especially for the larger and commercial types of storages. These should be reasonably sound and tightly constructed. If they are not, it is questionable whether extensive remodeling would be justified unless continued use as a storage is contemplated. Also, consideration should be given as to the depreciation that will be caused by installation of insulation and vent ducts in buildings to be used temporarily.

If there is a choice of buildings, one of wood frame construction, if tight, affords better insulation than one of masonry. However, masonry buildings are to be preferred to loose, poorly constructed ones of wood. They are also less of a fire hazard and usually provide better protection against rats.

Single- story, detached buildings are ordinarily more easily converted than other types. Narrow, deep buildings with other buildings attached are difficult to ventilate. Buildings with finished ceilings are most desirable because where roofs have widely spaced, open trusses ceiling joists are needed between the trusses and this necessitates the use of a large amount of material and labor. Ceilings higher than 11 or 12 feet are not needed and are uneconomical of heat. It is not desirable to use the second floor of an ordinary two-story building on account of the difficulty of strengthening the floor. Warehouses which have been designed for heavy loads are an exception to this rule. Basements can be used if reasonably dry and well ventilated. Buildings with chimneys are less of a fire hazard than those where the chimney must be improvised. Central heating systems are desirable as less labor is required for their operation and they are safer than stoves.

If it is anticipated that the building will be used only one or two seasons, a large expenditure for remodeling will not be warranted. The use of second-hand materials, and rock, poles, and local insulating materials such as cottonseed hulls, peanut hulls, sawdust, and shavings, reduce costs.

RECOMMENDATIONS FOR REMODELING

Foundations and Floors

Inspection of the foundation and floor is the first step in examining a building. In a lightly constructed building it may be necessary to strengthen the foundation to carry a heavier load. Girders of questionable strength may be stiffened by adding extra piers. Often joist spans must be reduced by supporting at the midpoint with a girder or solid wall. Table I shows the height of crates which joists of various sizes, spacings, and spans will carry. The recommendations are based on the use of dense No. 1 structural southern shortleaf yellow pine having a bending stress of 1,200 pounds per square inch. Information on the relative strength of other species of wood can be obtained from lumber dealers. It is advisable to consult an experienced builder as to how much strengthening the building may reguire to avoid overloading.

In buildings supported by piers where the flooring is in bad condition it would be advisable to remove the flooring and close in the spaces between piers. The best pieces of flooring could be selected and spaced an inch or more apart on the joists to allow air movement. In permanent storages it is better to fasten the slatted floor on 2 x 4 sleepers as shown in Figure 1 so that sections can be removed for cleaning and disinfecting. In temporary storages the space between piers might be closed with wood slabs and dirt piled behind on the inside. A facing of asbestos-cement board or similar material extending into the ground will help to prevent the entrance of rats. In many cases the above procedure will be much less expensive than repairing and insulting the floor. Where the building is to be remodeled into a permanent storage the closing walls between piers should be of masonry with footings at proper depth. See Farmers' Bulletin 1869, "Foundations for Farm Buildings."

In buildings with sound floors the slatted floor may be formed by laying 2 x 4's or 2 x 6's loosely on the floor to support the slats. The latter need not be nailed. In permanent storages the arrangement of joists and removable slatted floors illustrated in Figure 1 is recommended because this permits a better circulation of air.

Walls, Windows, and Doors

The repair of leaky masonry walls may not be economical for temporary storages but if not too leaky the walls can be made fairly water resistant by applying cement wash described below. For permanent storages the mortar joints should be raked out $\frac{1}{2}$ inch or more and repointed below ground with 1:2 portland cement mortar and above ground with 1:1:6 lime cement mortar. Sound but porous masonry can be made tight as follows: Apply grout, consisting of 70 percent portland cement, 30 percent lime mixed with $1\frac{1}{2}$ its volume of fine sand. Mix with

only sufficient water to obtain a brushing consistency. After 24 hours apply a second coat consisting of cement, lime, and water only. The wall should be dampened prior to applying the washes and then sprayed about an hour-and-a-half; it is best to work on the shady side and to rub the wash into the pores with a stiff fiber brush.

Most masonry walls require the addition of insulation in some of the zones, depending on the insulation value of the wall itself. (See Table 2.) Usually the best method is to attach furring strips to the wall as shown in Figure 1. The air space between the inside finish and the masonry is an effective insulator if the spaces are tightly sealed at top and bottom. If insulation board is applied directly to the wall by means of mastic, the face of the wall must be reasonably smooth and straight. Often this requires two coats of portland cement plaster.

Where an inside finish must be added to a wood frame wall the installation of building paper in the center of the stud space increases the insulating value of the wall by providing two air spaces in place of one. This is illustrated in Figure 2.

Windows are unnecessary in potato storages and should be boarded up and insulated in an amount equal to that of the wall to reduce heat loss. Fill insulation, either farm wastes or commercial products, might be placed between the boarding and the sash if protected against rain leakage. Insulation board panels can be applied if all joints are made tight. When covering windows and unnecessary doors, felt or other compressible material should be inserted between the covering and frame to reduce infiltration.

Doors should be insulated and made to fit tightly. In some cases weather stripping may be necessary. Often insulation board is applied to both sides of an ordinary door. Frequently two doors, one opening out and the other opening in, or a vestibule are used to reduce heat loss. This is especially desirable where high-cost heat such as electricity is to be used.

Ceilings

A smaller volume of air will be heated if the ceiling is applied to ceiling joists or horizontal ties rather than to the underside of the rafters. In temporary storages roofing felt may be tacked to the underside of joists and stripped occasionally with poles or slats to prevent sagging. Hulls, wood shavings, or commercial fill insulation can be placed on the felt. Other methods of insulating are suggested in Table 2.

In two-story buildings that are relatively rat proofed, loose fill insulation may be laid over the floor of the second story if it is not to be used for storage. A foot or more of hay might be used but this may present more of a fire hazard.

Insulation Requirements

A tight and well-insulated building is needed to secure economy in heating. The colder regions require better buildings if excessive fuel costs are to be avoided. Figure 3 shows a map of the main sweetpotato areas in the United States divided into 3 zones. Construction which provides an insulating value of 2.75 is recommended for Zone A, 3.66 for Zone B, and 5.50 for Zone C, for stove heat which is the most commonly used type.

Table 2 suggests types of construction which could be used in the various zones. All types of construction or insulation which might be encountered are not listed. Therefore, a table is included in the Appendix giving insulating values for the more common types of building and insulating materials for those who are familiar with building construction.

In figuring the total insulating value of a wall, ceiling, or floor the values of the component parts are added together. For example, reference to the second page of Table 2, shows that a 12-inch concrete block wall has a total insulating value of 2.05. Concrete block alone has a value of 1.28 for 12 inches. To this is added 0.167 because of the film of insulating air on the outside and 0.606 on the inside, making the total 2.05. If a half inch of insulation board is attached with mastic to the wall the total is increased 1.51 or one-half the value of a full inch of insulation board (3.03). The total then becomes 3.56. Another method of insulating would be to attach furring strips three-fourths of an inch thick to the wall and nail the one-half inch insulation on the strips. In this case an insulating value of 0.83 for the three-fourths of an inch air space must be added to the above total of 3.56, thus giving a total of 4.39. Either of the above additions would make the 12-inch concrete block wall usable in Zone B and the choice of which to use would depend upon the relative cost and ease of application for the particular installation.

By following this example the insulating value of various combinations of the materials listed in the Appendix can be determined.

If fill insulation is used, it should be protected from accumulations of moisture resulting from condensation of water vapor passing through the inside lining. In Zone A, where fill insulation is not likely to be used except in well-built houses heated by electricity, a vapor barrier is not really needed, especially when the houses are heated by stoves. In the warmer sections of Zone B, the fill insulation can be kept dry by ventilating the outside wall. This can be readily done by making small openings, such as bored holes, in the siding near the bottom and stop of the stud spaces. Sometimes it is feasible to provide openings into the roof space or attic. Attics and roof spaces can be ventilated by slots, louvers, or holes in the gable ends to keep dry the fill insulation when spread on the ceiling.

In Zone C, where there is likely to be a wide difference between inside and outside temperatures in winter, a vapor barrier is recommended. This should be a shiny waterproof felt or kraft paper fastened on the inside walls and ceilings just under the inside finish.

Some insulation boards are vapor-proofed at the factory and this protection is very desirable. Similar results may be obtained by applying hot asphalt to ordinary insulation board.

Heating

Uniform temperatures are essential for proper curing and storing. Electric heating is the most ideal; central heating systems already installed using oil, coal or wood-burning units with thermostatic control are next in desirability; while hand-fired stoves or brooders, although the most common, are the least desirable. The choice of the type of heater depends to a great extent upon the existance or availability of chimneys or the feasibility of building additional ones. In many cases chick brooder stoves could be borrowed to provide supplemental heat, especially if a short storage period is contemplated which does not overlap the brooding season. Where the available heaters have only sufficient capacity to maintain storage temperatures, brooder stoves, portable oil stoves, etc., can be utilized for additional heat during the curing period.

Brick brooders similar to those used for brooding chicks could be constructed if metal stoves cannot be obtained. Their use is feasible, however, only if the floors are of earth, concrete, or other noncombustible material.

Noncirculating stoves should be provided with a jacket elevated several inches above the floor and open at the top to assist air circulation and prevent overheating nearby potatoes. A sheet metal cylinder with an opening for firing the stove is the type most often used, but a pulley arrangement for lifting the jacket eliminates this opening. Other fire-resistance materials might be used and the jacket built in the form of a square. A jacket might be constructed of clay tile or cinder blocks with the lower courses laid with cells horizontal so as to permit entrance of air. A removable panel or door of fireproof material would serve to close the opening when the fire is not being tended. On wooden floors the stoves should be set in a box of sand to reduce the fire hazard. Instructions for building chimneys are given in Farmers' Bulletin 1889, "Fireplaces and Chimneys."

It is difficult to specify the size of stove needed because of the many factors involved, such as construction and size of building, location, exposure, kind of fuel, etc. Also the efficiency of the same size stove varies widely, depending on their design and operation. Where a heater is somewhat undersized, closer attention must be given to efficient firing and also to protection of the building, as a heater forced to its capacity for a longer period than usual is a fire hazard. Experience in heating similar buildings in the same locality is the best guide.

Ventilation

Incoming air should be discharged below the potatoes as wall openings at floor level will chill nearby potatoes. The exact method of providing ventilators differs with the way the structure is built. Figure 4 suggests several methods of constructing intake ventilators. Outtakes are usually flues carried through the roof as illustrated in Figure 4 and are equipped with hoods to prevent entrance of rain. They should be of one or two thicknesses of commercial insulating board. If not insulated moisture resulting from condensation may drip on the potatoes. Sliding, hinged, or pivoted dampers, controlled by ropes or rods, are needed to regulate ventilation. Ventilator sizes shown in Farmers' Bulletin 1442 may be safely reduced about one-half in area or fewer ventilators provided. A common outtake flue size is 16" by 16" or 18" by 18" which provides adequate ventilation for a 1,000- to 1,500-bushel house.

Special Considerations for Electric Heat

Better insulated buildings are required for economical heating by electricity. The following insulating values for wall, ceiling, and floor construction are recommended in place of those given on page 9 for stove heat: Zone A - 6.85, Zone B - 9.17, Zone C - 13.7. The additional insulation needed can be determined from values given in the table in the Appendix.

While the average cost of electricity for heating is at least four times that of coal heat in comparable structures, the following advantages offset this added cost:

1. Cost of electric equipment is less considering cost of stoves and chimneys.

2. Less space is required and more potatoes can be stored in the same size house.

3. Less labor is needed.- Operation is almost entirely automatic.

4. Temperatures are more uniform, resulting in less loss in weight and less spoilage.

5. The fire hazard is less.

In 23 electrically heated houses in Alabama, Georgia, Mississippi, and Tennessee during the seasons 1936 to 1940 inclusive, the cost for electric energy for curing and storing sweetpotatoes was 2 to 3 cents per bushel at an average power cost of 1.7 cents per kilowatt hour. House capacities ranged from 100 to 20,000 bushels. Costs per bushel in the smaller houses were higher than in larger ones. Two of the

houses in the colder zone were supplemented with stove heat during curing. In such cases about 60 percent of the heat is furnished by the electrical units which provide sufficient capacity to maintain desired storage conditions.

The average wattage installed per bushel in these houses was 4.14. This may need to be increased as much as 50 percent in very small storages. Farmers usually have transformer capacity sufficient to handle the heating load for 500- to 2,000-bushel houses.

A 115-volt electrical supply may be used where heaters total not more than 1,320 watts. A 230-volt supply should be used for larger loads.

Strip heaters (nonglow) of 500 or 1,000 watts are most commonly used. These are mounted under or between open floor joists and spaced throughout the house to provide even distribution of heat. A heater is usually placed above each air intake to warm the incoming air.

Thermostats should be equipped with relays in houses having a storage capacity greater than 1,000 bushels since, on the average, the connected heater load will be more than 25 amperes, which is above the rating of the more common thermostats.

Table 1. Safe Stacking Heights for Sweetpotatoes in Crates

Joist size 1/ Inches	Joist spacing in inches	Joist spans 6 ft.	8 ft.	10 ft.	12 ft.	14 ft.	16 ft.
2 x 6	12	5	3	2	1		
	16	4	2	1	1		
	18	3	2				
	24	2	1				
2 x 8	12	7	5	3	2	1	1
	16	5	4	2	2	1	
	18	4	3	2	1	1	
	24	3	2	1	1		
2 x 10	12	9	7	5	4	3	2
	16	7	5	4	3	2	1
	18	6	4	3	2	1	1
	24	4	3	2	1		
2 x 12	12	11	8	6	6	4	3
	16	9	6	5	4	3	2
	18	8	5	4	4	3	2
	24	6	4	3	3	2	1

1/ Safe stacking heights figured for joists dressed S4S.

Table 2.—Suggested Types of Construction and Their Insulating Values for Sweetpotato Storages Using Stove Heat

WALLS

8" Brick, Cinder Block or Clay Tile (2.37 [1])

ZONE A (Approx. Insul. Value of 2.75 required)		ZONE B (Approx. Insul. Value of 3.66 required)		ZONE C (Approx. Insul. Value of 5.50 required)	
Additional Construction Needed	New Insul. Value	Additional Construction Needed	New Insul. Value	Additional Construction Needed	New Insul. Value
None	(2.37) (Basic Value)	3/4" furring, paper, ½" gypsum board, [2] paper	3.58	3/4" furring, 3/4" insulation board	5.45
		Mastic, ½" insulation board	3.87	Mastic, 1" insulation board	5.40
12" Brick, Cinder Block, or Clay Tile (3.17 [1])					
None	(3.17) (Basic Value)	3/4" furring, hardboard [3]	4.00	3/4" furring, ½" insulation board	5.51
				3/4" furring, peanut hulls [4] hardboard	5.39
				Mastic, 3/4" insulation board	5.42
16" Brick, Cinder Block, or Clay Tile (4.11 [1])					
None	(4.11) (Basic Value)	None	(4.11) (Basic Value)	3/4" furring, paper, ½" gypsum board, paper	5.32
				3/4" furring, cottonseed hulls, hardboard	6.01
				Mastic, ½" insulation board	5.62
8" Monolithic Concrete or Stone (1.43 [1])					
Mastic, ½" insulation board	2.94	Mastic, 3/4" insulation board	3.68	Mastic, 1½" insulation board	5.94
3/4" furring, paper, ½" gypsum board, paper	2.64	3/4" furring, peanut hulls, hardboard	3.64	1-5/8" furring, peanut hulls, hardboard	6.15
		3/4" furring, cottonseed hulls, paper, gypsum bd., paper	3.64	1-5/8" furring, cottonseed hulls, paper, gypsum bd., paper	5.77
				3/4" furring, 1" insulation lath, 3/4" plaster	5.39

Table 2 - Continued

WALLS

ZONE A (Approx. Insul. Value of 2.75 required) Additional construction needed	New Insul. Value	ZONE B (Approx. Insul. Value of 3.66 required) Additional construction needed	New Insul. Value	ZONE C (Approx. Insul. Value of 5.50 required) Additional construction needed	New Insul Value
12" Monolithic Concrete or Stone (1.72 1/)					
3/4" furring, hardboard	2.65	3/4" furring, cottonseed hulls, hardboard	3.65	3/4" furring, fill insulation, ½" insulation board	5.76
				1-5/8" furring, 1" blanket insulation, hardboard	5.92
		3/4" furring, ½" insul. bd.	4.09	3/4" furring, 1" insul. bd.	5.61
		Mastic, 3/4" insul. bd.	4.01	Mastic, 1¼" insul. bd.	5.52
16" Monolithic Concrete or Stone (2.04 1/)					
3/4" furring, hardboard	2.98	3/4" furring, hulls or shavings, hardboard	3.98	3/4" furring, hulls or shavings, ½" insul. board	5.42
		3/4" furring, ½" insul. bd.	4.42	3/4" furring, 1" insul. bd.	5.94
		Mastic, ½" insul. board	3.59	Mastic, 1¼" insul. bd.	5.86
8" Concrete Block (1.79 1/)					
3/4" furring, hardboard	2.69	3/4" furring, cottonseed hulls, hardboard	3.69	1-5/8" furring, cottonseed hulls, hardboard	5.82
		Mastic, 3/4" insul. bd.	4.05	Mastic, 1¼" insul. bd.	5.57
		3/4" furring, ½" insul. bd.	4.13	3/4" furring, 1" insul. bd.	5.65
		3/4" furring, paper, 3/4" furring, hardboard	3.52		
12" Concrete Block (2.05 1/)					
3/4" furring, hardboard	2.94	3/4" furring, cottonseed hulls, hardboard	3.68	1-5/8" furring, cottonseed hulls, hardboard	6.07
		Mastic, ½" insul. bd.	3.56	Mastic, 1¼" insul. bd.	5.82
		3/4" furring, ½" insul. board	4.39	3/4" furring, 1" insul. board	5.89

Table 2 - Continued

WALLS

3/4" Siding on Outside of Studs (1.67[1/])

ZONE A (Approx. Insul. value of 2.75 required)		ZONE B (Approx. Insul. Value of 3.66 required)		ZONE C (Approx. Insul. Value of 5.50 required)	
Additional construction needed	New Insul. Value	Additional Construction needed	New Insul. Value	Additional construction needed	New Insul. Value
Paper, 9/16" ceiling on inside........................	3.18	Paper between studs, paper 9/16" ceiling on inside.....	4.00	Paper between studs, 3/4" insulation bd. on inside...	5.59
Paper between studs, hardboard on inside.........	3.40	Paper between studs, paper ½" gypsum bd., paper on inside	3.71		
Paper, ½" gypsum board, paper on inside.............	2.88	½" insulation board on inside.......................	4.02	1" insul. board on inside...	5.53
Wood lath and plaster on inside......................	2.90				

3/4" Siding, paper, 3/4" Sheathing on Outside of Studs (2.56[1/])

None........................	(2.56) (Basic Value)	Paper, 9/16" ceiling on inside........................	4.06	Paper, 9/16" ceiling, ½" insul. board on inside....	5.57
		Hardboard on inside...........	3.46	Paper between studs, ½" insul. bd. on inside......	5.73
				3/4" insul. bd. on inside...	5.65
		Paper, ½" gypsum board, paper on inside...............	3.77	Sheathing, paper, 3/4" ceiling on inside[2/]	5.17
		Wood lath and plaster on inside........................	3.79	Paper between studs, sheathing, paper, 9/16" ceiling on inside.................	5.78

Table 2 - Continued

ROOFS

Asphalt, Asbestos-cement, Tile or Slate Shingles, or Composition
Roofing on Solid Wood Sheathing on Rafters (1.79 1/)

ZONE A (Approx. Insul. Value of 2.75 required)		ZONE B (Approx. Insul. Value of 3.66 required)		ZONE C (Approx. Insul. Value of 5.50 required)	
Additional Construction Needed	New Insul. Value	Additional Construction Needed	New Insul. Value	Additional Construction Needed	New Insul Value
Paper, ½" gypsum board, paper........................	3.00	Sheathing, paper, 9/16" wood clg...............	4.18	Sheathing, paper, 9/16" wood, clg., ½" insul. bd.........	5.69
Paper, 3/4" furring, paper.......................	3.45	Sheathing, paper, 3/4" furring, paper...............	4.34	Sheathing, paper, 3/4" furring, ½" insul. bd.......	5.85
		½" insulation board or blanket...................	4.13	1" insulation board or blanket/.................	5.64
Paper between rafters, hard board below...........	3.52	Paper between rafters, ½" gypsum bd, paper.........	3.83	Paper between rafters, 3/4" insul. bd.	5.71

Ceiling Applied to Ceiling Joists with Attic Above

Where attic is tight and with no windows or dormers, insulating values are approximately equal to construction with ceiling applied to underside of rafters. If attic is not tight and has windows or dormers, more insulation should be used on the ceiling. If attic has ventilators so that attic temperature is about the same as the outside, neglect the insulating value of the roof and add sufficient insulation to the ceiling.

FLOORS

Wood floors on piers should have insulating value comparable to walls.

1/ Figures in parentheses at end of center headings show insulating values before additional construction.
2/ Gypsum board will not withstand extreme dampness and must be protected on both sides with vaporproof paper.
3/ The term "hardboard" includes dense building boards 1/8" to ¼" in thickness such as asbestos-cement, pressed wood fiber, laminated asphalt saturated felt, etc. The insulating values of these boards are approximately the same.
4/ Cottonseed hulls, peanut hulls, sawdust, and planer shavings have similar insulating values and where one material is listed in the table the others can be substituted with little effect on the total insulating value.
5/ Construction recommended in Farmers' Bulletin 1442, "Storage of Sweetpotatoes".

Table 2 - Continued

ROOFS

Ceiling Applied Directly to Underside of Rafters on Pitched Roof
or to Ceiling Joists on Flat Roof

Wood Shingles on 1 x 4 strips 2 inches apart on Rafters (2.17 1/)

ZONE A (Approx. Insul. Value of 2.75 required)		ZONE B (Approx. Insul. Value of 3.66 required)		ZONE C (Approx. Insul. Value of 5.50 required)	
Additional Construction Needed	New Insul. Value	Additional Construction Needed	New Insul. Value	Additional Construction Needed	New Insul. Value
Hardboard, roll roofing or paper..................	3.08	Paper, 9/16" wood ceiling.....................	3.68	9/16" wood clg., 3/4" insul.bd.	5.94
		½" insulation board or blanket.....................	4.52	1" insulation blanket......................	6.03
		3/4" sheathing, paper, 9/16" wood clg..............	4.57	Sheathing, 9/16" wood clg., ½" insul. bd.................	6.08
		Paper, 3/4" furring, paper.....................	3.93	9/16" clg., furring 3/4", ½" insul. bd................	6.02

Sheet Metal on 1 x 4 strips 2" apart on rafters (1.23 1/)

Paper, 3/4" wood ceiling....................	2.95	Paper, 3/4" wood clg., 3/4" furring, paper...........	3.85	3/4" wood clg. paper, 3/4" furring, 3/4" insul.bd......	6.03
Paper between rafters, paper below..............	2.89	Paper, between rafters, ½" insul. blanket........	4.65		
		½" insulation blanket..................	3.73	1¼" insulation board or blanket................	5.83
		Wood sheathing, paper, 3/4" wood clg............	3.84	½" insul. blanket between, ½" insul. board below.....	6.07

APPENDIX

Insulating Values of Various Building and Insulating Materials, Air Spaces, and Surface Resistance

Material	Insulating value
Surface resistance - outside air	0.17
Surface resistance - inside air	0.61
Air space 3/4" to 3 5/8"	0.83
Brick	(8" - 2.37) (12" - 3.17) (16" - 4.11)
Concrete	(8" - 1.43) (12" - 1.75) (16" - 2.08)
Stone	(8" - 1.41) (12" - 1.72) (16" - 2.04) (24" - 2.70)
Concrete block	(8" - 1.79) (12" - 2.05)
Cinder block	(8" - 2.38) (12" - 2.70)
Hollow tile	(8" - 2.50) (12" - 3.33) (16" - 4.00)
* Wood, yellow pine	(3/4" - 0.89) (9/16" - 0.67)
* Plaster, portland cement, 1"	0.13
* Cottonseed hulls, wood shavings or sawdust	(3/4" - 1.83) (1 5/8" - 3.96) (3 5/8" - 8.85) (5 5/8" - 13.72)
* Peanut hulls	(3/4" - 2.15) (1 5/8" - 4.65) (3 5/8" - 10.35) (5 5/8" - 16.10)
* Insulating board, commercial	(½" - 1.51) (3/4" - 2.26) (1" - 3.03)

Material	Insulating value
* Loose fill, bat or blanket type insulation	(½" - 1.67) (3/4" - 2.50) (1 5/8" - 5.43) (3 5/8" - 12.10) (5 5/8" - 18.80)
* Wood lath and plaster, 3/4"	.40
* Asbestos-cement board 3/16"	.07
* Asphalt felted board 1/8"	.18
* Asphalt felted roofing 1/16"	.09
* Pressed wood fibre board 3/16"	.13
* Gypsum board ½"	.38
* Wood shingles	.78
* Asphalt shingles	.15
* Asbestos-cement shingles	.17
Wood shingles on 1 x 4 strips 2" apart	2.18
Sheet metal on 1 x 4 strips 2" apart	1.23
Asphalt, asbestos-cement, tile or slate shingles, or composition roofing on solid wood sheathing on rafters	1.79

Note: Values given for items preceded by asterisk (*) do not include values for surface resistance.

- -o O o- -

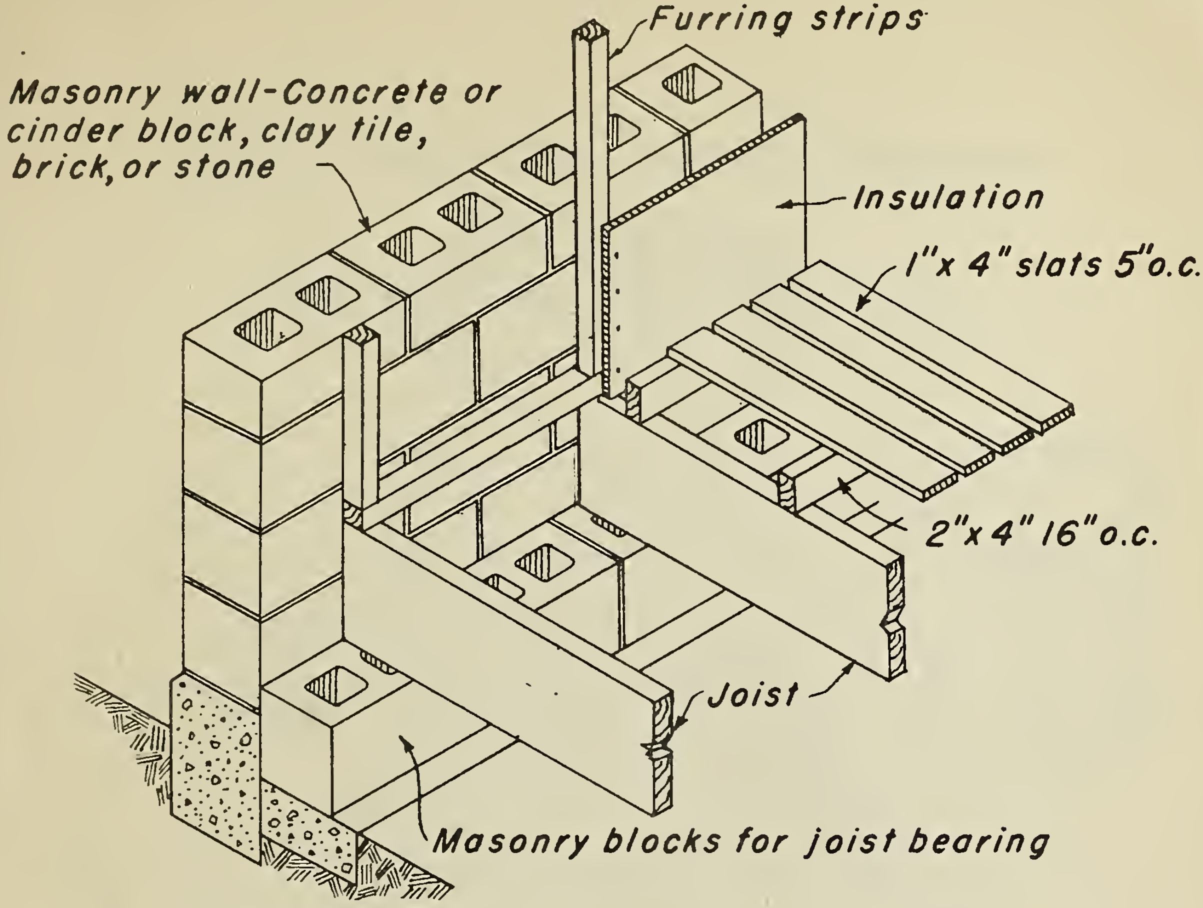

Fig.-1 FURRING A MASONRY WALL
Note floor with open slats

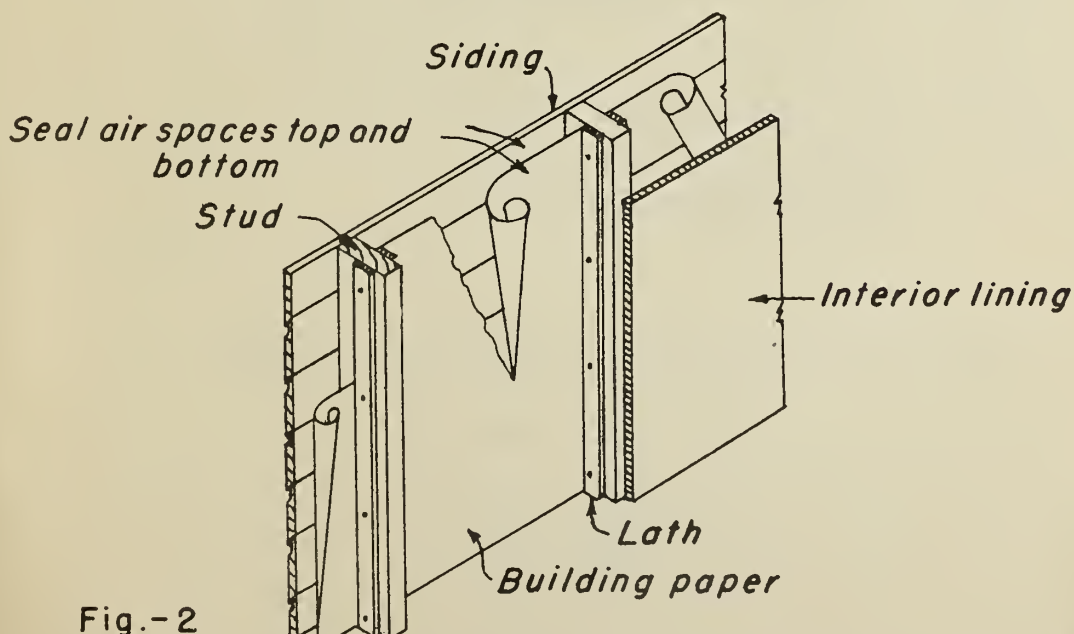

Fig.-2
ADDITIONAL DEAD-AIR SPACE FORMED BY PAPER PLACED BETWEEN STUDS. *Increases insulating value of wall*

CONSTRUCTION REQUIREMENTS

ZONE MAP FOR SWEETPOTATO PRODUCING AREA

SWEETPOTATO PRODUCING AREA EAST AND SOUTH OF HEAVY BROKEN LINE

AVERAGE DAILY MINIMUM TEMPERATURES FOR OCTOBER

ZONE (A) = 57 °F.

ZONE (B) = 52 °F.

ZONE (C) = 47 °F.

FIG.-3

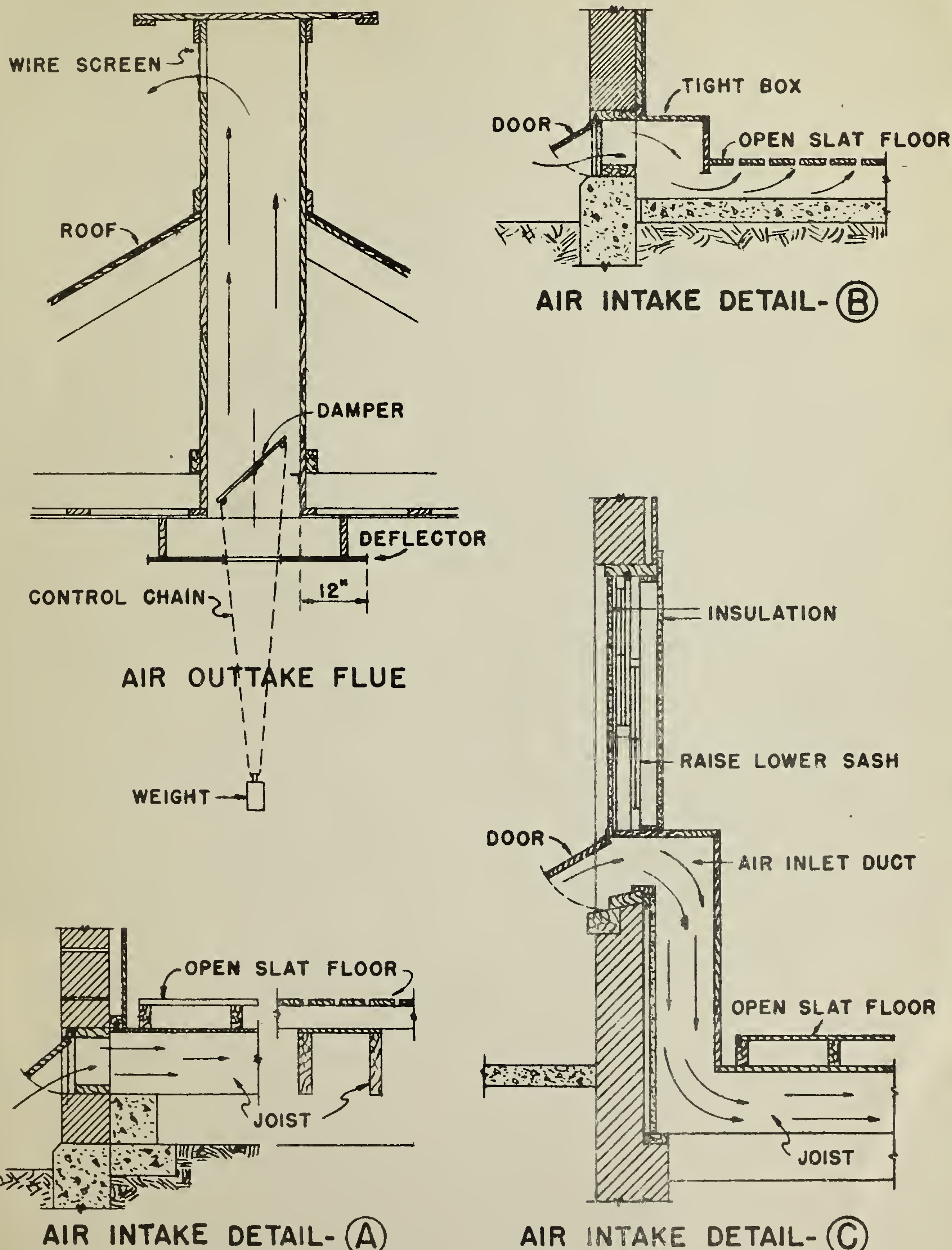
WIRE SCREEN
ROOF
DAMPER
DEFLECTOR
CONTROL CHAIN
12"
AIR OUTTAKE FLUE
WEIGHT
TIGHT BOX
DOOR
OPEN SLAT FLOOR
AIR INTAKE DETAIL- (B)
INSULATION
RAISE LOWER SASH
DOOR
AIR INLET DUCT
OPEN SLAT FLOOR
JOIST
OPEN SLAT FLOOR
JOIST
AIR INTAKE DETAIL- (A)
AIR INTAKE DETAIL- (C)

FIG.- 4